

What is claimed is:

1. A heterojunction structure comprising a p-type semiconductor thin film and an n-type ZnO-based nanorod epitaxially grown thereon.
- 5 2. The heterojunction structure of claim 1, wherein the p-type semiconductor is made of a material having a band-gap energy ranging from 1.5 to 4.5 eV.
- 10 3. The heterojunction structure of claim 2, wherein p-type semiconductor is made of a material selected from the group consisting of GaN, AlN, GaP, GaAs, ZnSe, CdSe, CdS, ZnS, SrCu₂O₂, SiC and Si.
- 15 4. The heterojunction structure of claim 1, wherein the p-type semiconductor thin film has a thickness ranging from 50 nm to 200 μm .
5. The heterojunction structure of claim 1, wherein the ZnO-based nanorod has a diameter in the range of 5 to 100 nm and a length in the range of 5 nm to 100 μm .
- 20 6. The heterojunction structure of claim 1, wherein the ZnO-based nanorod is a ZnO nanorod or a heteromaterial-doped or coated ZnO-nanorod.
7. The heterojunction structure of claim 6, wherein the heteromaterial is selected from the group consisting of Mg, Mn, Cd, Se and mixtures thereof.
- 25 8. The heterojunction structure of claim 6, wherein the doped

heteromaterial is selected from the group consisting of $\text{Zn}_{1-x}\text{Mg}_x\text{O}$ ($0 < x < 1$), $\text{Zn}_{1-x}\text{Mn}_x\text{O}$ ($0 < x < 1$), $\text{Zn}_{1-x}\text{Cd}_x\text{O}$ ($0 < x < 1$) and $\text{Zn}_{1-x}\text{Se}_x\text{O}$ ($0 < x < 1$).

9. A method for preparing the heterojunction structure of claim 1, which
5 comprises bringing the vapors of a Zn-containing metal organic compound and an O_2 -containing compound as reactants separately into contact with a p-type semiconductor thin film at a temperature in the range of 400 to 700 °C under a pressure in the range of 0.1 to 10 torr to form a ZnO nanorod on the surface of the semiconductor film.
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10. A nano-device or an array thereof comprising the heterojunction structure of claim 1.
11. A nano-system or an integrated circuit comprising the nano-device
15 array of claim 10.